

This Page Is Inserted by IFW Operations  
and is not a part of the Official Record

## **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning documents *will not* correct images,  
please do not report the images to the  
Image Problem Mailbox.**

What is claimed is:

Sub  
Ena

1. A magnetic recording medium comprising:  
a substrate;  
a non-magnetic spacer material on the substrate; and  
a soft magnetic underlayer on the non-magnetic spacer material, the soft magnetic underlayer containing iron, cobalt and boron.
2. The magnetic recording medium as recited in claim 1, wherein the non-magnetic spacer material is approximately 0-5 nm thick.
3. The magnetic recording medium as recited in claim 1, wherein the soft magnetic underlayer is approximately 240 nm thick.
4. The magnetic recording medium as recited in claim 3, wherein the soft magnetic underlayer is comprised of alternating layers of an iron-cobalt alloy and tantalum.
5. The magnetic recording medium as recited in claim 4, wherein the SUL comprises that iron-cobalt layers of about 80 nm thick and three tantalum layers of about 0-5 nm thick.
6. The magnetic recording medium as recited in claim 4, wherein the SUL comprises a first iron-cobalt layer of about 80 nm thick and a second iron-cobalt layer of about 160 nm thick having a tantalum layer of about 0-5 nm thick therebetween.

7. The magnetic recording medium as recited in claim 1, wherein the soft magnetic underlayer is further comprised of about 90 atomic percent iron-cobalt alloy and about 10 atomic percent of boron.

8. The magnetic recording medium as recited in claim 4, wherein the iron-cobalt alloy is further comprised of about 65 atomic percent iron and about 35 atomic percent cobalt.

9. The magnetic recording medium as recited in claim 1, further comprising a plurality of alternating non-magnetic spacer material and soft magnetic underlayers.

10. The magnetic recording medium as recited in claim 1, further comprising a second non-magnetic spacer material on the soft magnetic underlayer.

11. The magnetic recording medium as recited in claim 7, further comprising a perpendicular magnetic recording layer on the second non-magnetic spacer material.

12. The magnetic recording medium as recited in claim 6, further comprising a second non-magnetic spacer material on the soft magnetic underlayer.

13. The magnetic recording material as recited in claim 1, wherein the non-magnetic spacer material contains tantalum.

14. A method of manufacturing a perpendicular magnetic recording medium, the method comprising:

providing a substrate,

depositing a non-magnetic spacer material on the substrate;

depositing a soft magnetic underlayer containing iron, cobalt and boron on the non-magnetic spacer material; and

depositing a perpendicular magnetic recording material on the soft magnetic underlayer.

15. The method as recited in claim 11, wherein the step of depositing the soft magnetic underlayer comprises depositing a soft magnetic underlayer containing approximately 90 atomic percent iron-cobalt alloy and approximately 10 atomic percent boron.

16. The method as recited in claim 12, wherein the step of depositing the soft magnetic underlayer further comprises depositing a soft magnetic underlayer having a iron-cobalt alloy containing approximately 65 atomic percent iron and approximately 35 atomic percent cobalt.

17. The method as recited in claim 11, wherein the step of depositing the soft magnetic underlayer includes depositing the soft magnetic underlayer at a thickness of about 80 nm.

18. The method as recited in claim 13, wherein the step of depositing the soft magnetic underlayer includes depositing the soft magnetic underlayer at a thickness of about 80 nm.

19. The method as recited in claim 11, wherein the step of depositing the non-magnetic spacer material comprises depositing a tantalum layer on the substrate.

20. The method as recited in claim 16, wherein the tantalum layer is deposited at a thickness of about 1-5 nm.

21. The method as recited in claim 14, wherein the step of depositing the non-magnetic spacer material comprises depositing a tantalum layer on the substrate.

22. The method as recited in claim 18, wherein the tantalum layer is deposited at a thickness of about 1-5 nm.

23. The method as recited in claim 15, wherein the step of depositing the non-magnetic spacer material comprises depositing a tantalum layer on the substrate.

24. The method as recited in claim 20, wherein the tantalum layer is deposited at a thickness of about 1-5 nm.

25. The method as recited in claim 11, further comprising the step of depositing a second non-magnetic spacer material on the soft magnetic underlayer under the perpendicular recording medium.

26. A method of manufacturing a magnetic recording medium, the method comprising:  
providing a substrate;  
depositing a first non-magnetic spacer material on the substrate;  
depositing a soft magnetic underlayer containing iron, cobalt and boron on the non-magnetic spacer material; and

~~cond non-~~

Sum  
A4

~~The 1  
perpen~~

242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----